Remarks

Claims 1-7 are pending herein. By this Amendment, claims 1-3, 5 and 7 have been amended, and the specification has been amended to correct a minor typographical error.

Claim 1 has been amended at line 4 to recite that the "other surface of the piezoelectric element plate is non-flat". Support for this amendment can be found, e.g., in claim 2 which uses the term "non-flat" to refer to said surface. Support can also be found, e.g., in Figs. 2-4. Claim 2 has been amended to delete the term "side" from the recitation "non-flat side surface of piezoelectric element plate" because such term was not used in claim 1.

Claims 3 and 5 have been amended to recite that the lower surface of the piezoelectric element plate is non-flat. Support for this amendment can be found, e.g., in claim 7 and in Figures 2-4. Claim 7 has been amended to delete the term "side" from the recitation "non-flat side surface of piezoelectric element plate" because such term was not used in claims 3, 4 or 5.

In the Office Action, claim 7 is objected to; and claims 1-7 are rejected under 35 U.S.C. §103(a) as being unpatentable over JP2001-292048 to Takashi ("Takashi") in view of JP 55-153416 to Joji ("Joji").

In view of the amendments and remarks herein, Applicant respectfully requests reconsideration and withdrawal of the objection and rejection set forth in the Office Action.

I. The Objection

Claim 7 is objected to under 37 CFR §1.75(c) as being in improper form because it is said to depend upon claim 6, i.e., a multiple dependent claim. According to §1.75(c), a multiple dependent claim shall not serve as a basis for any other multiple dependent claim. However, claim 7 does not depend upon claim 6, but rather upon claims 3, 4 or 5. Because none of claims 3, 4 or 5 is a multiple dependent claim, Applicant respectfully submits that the objection to claim 7 is improper.

II. The Rejection Under 35 U.S.C. §103(a)

In the rejection of claims 1-7 under §103(a), Takashi is cited for disclosing a rectangular piezoelectric element plate (11) having a flat surface at one surface, a package (12), a bump (41), and an electrode (31). Regarding claim 3, Takashi is cited for teaching joining the plate to the package via the bump while pressing (F) the plate against the package (see Figure 8). Regarding claims 4-6, Takashi is cited for disclosing the application of ultrasonic waves (see Figure 8), the

use of an adsorbing nozzle (55), and the use of extraction electrodes (31). According to the Office Action, Takashi does not disclose the plate having a reduced thickness or a beveling circular arc on the other surface (as set forth in instant claims 1, 2 and 7).

Joji is cited for disclosing a piezoelectric plate having a flat surface and a bevel circular arc surface opposing the flat surface (Figs. 1b and 1c) for forming a small size and high performance device (see Abstract).

According to the Office Action, it would have been obvious in view of Joji to modify the plate disclosed in Takashi by using the bevel surface on one of the surfaces of the plate "for the purpose of having a small size and high performance device".

Applicant respectfully submits that claims 1-7 would not have been obvious over Takashi in view of Joji.

A. Claims 1 and 2

Instant claims 1 and 2 are directed to a piezoelectric device, claim 1 being independent and claim 2 depending upon claim 1.

The device of instant claim 1 (as amended herein) includes the following features:

> -one surface of the piezoelectric element plate is formed to be flat,
>
> - the other surface of the piezoelectric element plate is non-flat and is worked at both longitudinal end parts in a manner such that the thickness of the end parts gradually reduces toward both longitudinal end faces, and
>
> - the package and the piezoelectric element plate are joined with each other via a bump formed between the upper surface of the package and one longitudinal end part on said other surface (non-flat surface) of the piezoelectric element plate.

Claim 2 (as amended herein) recites that a "beveling circular arc form is formed at both end parts on the non-flat surface of the piezoelectric element plate."

Regarding the piezoelectric device of the present invention, the instant specification teaches that:

> in this application, with the plate shape side of the upper surface of the piezoelectric device as the mounting reference, the surface of the piezoelectric device, along which the thickness of the piezoelectric device is gradually reduced toward the both

> longitudinal end faces of the piezoelectric device, is joined to the package via the bumps, so that it is possible to perform mounting in a state where the upper surface is in parallel with the package, and ***to thereby obtain an extremely thin piezoelectric device. In addition, since both end parts of the piezoelectric device have a bevel shape, it is possible to obtain stable vibration.*** (page 11, lines 17-27)

Thus, the features of instant claims 1 and 2 provide an extremely thin piezoelectric device having stable vibration.

As noted above, one of the features of the claimed piezoelectric device is that the package and the piezoelectric element plate are joined with each other via a bump formed between the upper surface of the package and on one longitudinal end part on said other surface of the piezoelectric element plate. In this recitation, the expression "said other surface of the piezoelectric element plate" means "the other surface" of the piezoelectric element plate where the thickness of the end part is gradually reduced toward both longitudinal end faces. In other words, said "other surface" of the piezoelectric element plate is a surface on the opposite side of "one surface formed to be flat." More specifically, said "other surface" is a non-flat surface.

Another feature of the claimed device is that the non-flat surface of the piezoelectric element plate is worked at both longitudinal end parts in a manner such that the thickness of the end parts gradually reduces toward both longitudinal end faces.

Thus, as can be seen in Figure 2, bumps 4 for joining piezoelectric element plate 2 to the package 3 are interposed between the upper surface (specifically stage part 3a) of package 3 and the non-flat surface of piezoelectric element plate 2, the thickness of the non-flat surface gradually reducing toward both longitudinal end faces. These features are not taught or suggested in Takashi or Joji, either individually or in combination.

Takashi discloses bumps being interposed between the upper surface of the package and the flat surface of the piezoelectric element plate. As acknowledged in the Office Action, however, Takashi does not disclose the plate having a reduced thickness or a beveling circular arc on the other surface. Thus, Takashi does not teach or suggest bumps being interposed between the upper surface of the package and the non-flat surface of the piezoelectric element plate, the thickness of the non-flat surface gradually reducing toward both longitudinal end faces.

In Joji, one surface of the oscillator is composed of electrode 15 and non-electrode part 17, and the other surface of the oscillator is composed of electrode 16 and non-electrode part 18. For purposes of this discussion, the surface composed of electrode 15 and non-electrode part 17 will be referred to as "the first surface", and the surface composed of electrode 16 and non-electrode part 18 will be referred to as "the second surface". Although the first and second surfaces each have flat portions (i.e., electrodes 15 and 16, respectively), neither the first surface nor the second surface is a "flat" surface (i.e., a surface that is flat in its entirety).

Furthermore, neither the first surface nor the second surface of the Joji oscillator is individually constructed such that the thickness of an individual non-flat surface is gradually reduced toward both longitudinal end faces. The thickness of the first surface, at non-electrode part 17, is gradually reduced toward only one longitudinal end face (face "C"). Likewise, the thickness of the second surface, at non-electrode part 18, is gradually reduced toward only one longitudinal end face (face "B").

In addition, Joji does not teach any specific relationship between the oscillator therein and a package. Thus, Joji does not teach or suggest between what particular surfaces (flat or non-flat) of the plate and the package a bump or bumps should be interposed.

Thus, Takashi and Joji, in combination, do not teach or suggest a piezoelectric device having bumps interposed between an upper surface (or any surface) of a package and a non-flat surface of a piezoelectric element plate, the thickness of the non-flat surface gradually reducing toward both longitudinal end faces.

Therefore, for at least the foregoing reasons, Applicant respectfully submits that claims 1 and 2 would not have been obvious over Takashi in view of Joji.

B. Claims 3-7

Claims 3-7 are directed to methods for manufacturing a piezoelectric device. Claims 3 and 5 are independent. Claim 4 depends upon claim 3, claim 6 depends on claim 4 or 5, and claim 7 depends on any one of claims 3, 4 and 5.

Independent claim 3 (as amended herein) includes the following features:

> - the upper surface of the piezoelectric element plate is formed to be flat,
>
> - the lower surface of the piezoelectric element plate is non-flat and is worked at both longitudinal end parts in a manner such that

the thickness of the end parts gradually reduces toward both longitudinal end faces, and

- the package and the piezoelectric element plate are joined to each other, via a bump, at one of the longitudinal end parts on the lower surface (i.e., non-flat surface) of the piezoelectric element plate.

Independent claim 5 (as amended herein) includes the following features:

- the upper surface of the piezoelectric element plate is formed to be flat,

- the lower surface of the piezoelectric element plate is non-flat and is worked at both longitudinal end parts in a manner such that the thickness of the end parts gradually reduces toward both longitudinal end faces, and

- the package and the piezoelectric element plate are joined to each other via a bump formed at one of the longitudinal end parts on the lower surface (i.e., non-flat surface) of the piezoelectric element plate.

For the reasons given above, Takashi and Joji, in combination, do not teach or suggest a piezoelectric device having bumps interposed between a surface of a package and a non-flat surface of a piezoelectric element plate, the thickness of the non-flat surface gradually reducing toward both longitudinal end faces. Thus, Takashi and Joji, in combination, do not teach or suggest a method of manufacturing such a piezoelectric device.

Therefore, for at least the foregoing reasons, Applicant respectfully submits that claims 3-7 would not have been obvious over Takashi in view of Joji.

III. Conclusion

In view of the amendments and remarks herein, Applicant respectfully requests that the objection and rejection set forth in the Office Action be withdrawn and that claims 1-7 be allowed.

If any additional fees are due in connection with the filing of this paper, such as fees under 37 C.F.R. §§1.16 or 1.17, please charge the fees to Deposit Account 02-4300; Order No. 032213M040.

Respectfully submitted,

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Enclosures: (1) Petition for Extension of Time
(2) Check for the sum of $1020

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